

Bazillian ornamental rock imports and exports: A study of the impact of Covid-19 in the market

Márcio Henrique Alves¹, Giselle Paula Guimarães Castro², Diorgenes dos Santos³, Francisco Fittipaldi Vessani⁴, José de Araújo Nogueira Neto⁵

^{1,2}Bachelor in Civic Engineering (UFG), GO, Brazil.

³Bachelor in Administration (UEG), GO, Brasil.

⁴Bachelor in Geology pela Universidade de Brasília, DF, Brazil.

⁵Doctor in Regional Geology by Universidade Estadual Paulista (UNESP), SP, Brazil.

Received: 18 Oct 2020; Received in revised form: 11 Nov 2020; Accepted: 15 Nov 2020; Available online: 16 Nov 2020

Abstract — *The present study will present a brief historical context, methods and proceedings of the Brazilian ornamental rock export market. The impacts and crisis generated by the global Covid-19 pandemic was characterized, and expressive reduction was verified. The analyzed period was the first semester (January through June) 2020, epoch in which occurred the beginning of the pandemic. We presented numbers and details of the sector through a comparative analysis to the same period of 2019 and 2018. We present a brief context of what can happen in the next moments in this sector, in an indication of extension of the crisis generated by the Covid-19 impacts. We present methods that address the ornamental rock market in Brazil and its relationship with its most important export and import countries in the world with data from official sources, separated by rock types to better understand the impacts on the market. We present in this study what the market can go through with the global pandemic.*

Keywords— *Pandemic, COVID-19, Ornamental, Rock, Exports.*

I. INTRODUCTION

Over mankind's history, minerals had a fundamental role in the advancement of the industry and technology (KLEIN et al, 2012). Minerals are crystalline, solid substances formed through natural processes (KLEIN et al, 2012). The ones with economic value are called ores, resources that we use in our every day life and impact directly in our economy (KLEIN et al, 2012).

Rocks are crystalline aggregates of many minerals in a solid structure, and rocks, as with minerals, may have economic value, also becoming ores. Ornamental rocks are defined as natural rock material, subjected to different types and degrees of manufacturing (brute, sliced, sculpted, or polished), that are used in an aesthetic way (ABNT). Ornamental rocks are classified according to the export market in two main groups: marbles and granites (COSTA, 2001). These names are consolidated in the market and used worldwide to designate these objects, that are extracted in blocks and sliced, in which the production

chain involves four main steps: deposit prospecting, extraction, manufacturing and commercialization.

Ornamental rocks are used as construction material since ancient Egypt, with relevance as an ornamental material in Italy I B.C. Roman people used travertine marble, and even with the ever-growing scarcity of this material, it is still explored in the region of Carrara, Italy.

The ornamental rock market has a great global demand, in which developed countries are the main importers, and the countries in development, as Brazil, are the main exporters (SINDIROCHAS 2019).

The year of 2020 was marked by the emergence of a new global disease, and China was the first country to be affected by the Coronavirus COVID-19 (McKibbin et al, 2020). The first case, in Wuhan, occurred around December 2019 (Khan et al, 2020). Governments of affected countries took various measures to stop the spread of the disease, that included airport lockdown, port lockdown, rail and highway closure, and even curfew and

cities lockdown, that caused great impact on global economy, that resulted in different number of confirmed cases (Graphic 1).

The present study aims to analyze the impacts of the pandemic in the ornamental rocks sector through an analysis of exterior commerce data from the Economy Ministry of Brazil, along with official pandemic data from John Hopkins University, in Baltimore - EUA

II. METHODOLOGY

The methodology consisted in collecting data from the ComexStat platform (<http://comexstat.mdic.gov.br>), from the Ministry of Economy of Brazil. This platform reports monthly the official import and export data of Brazil, divided into many categories, by country and type of product, using the worldwide known SH system, notably the Class (SH4), Subposition (SH6) and the Mercosul Common Nomenclature (NCM). With data in hand, tables and graphics were made to better visualize the numbers.

The Covid-19 data used was obtained from the Data Repository by the Center for Systems Science and

Engineering (CSSE), Johns Hopkins University, obtained through GitHub platform. GitHub is an online database host that allows multiple users to have access to databases of various open source projects throughout the world. To make the graphics we utilized Microsoft PowerBI Desktop (<https://powerbi.microsoft.com>).

The analysed periods were the first semester (January to June) 2018, 2019 and 2020. These periods will be referred as 1S18, 1S19 and 1S20, respectively. Values of medium price and its variations were also calculated for the periods investigated, and separated by country, to identify the major contributors to the results.

To compose the ornamental rock database, we divided this sector in five categories: 1. Brute Carbonatic Rocks; 2. Brute Silicate Rocks; 3. Manufactured Carbonatic Rocks; 4. Manufactured Silicate Rocks; and 5. Slates and other rocks. To classify the export products in these categories, we used the same criteria as the SINDIROCHAS entity (www.sindirochas.com) in its monthly exports report, dividing the NCMs that are considered ornamental rocks in the 5 categories, as summarized in the table below.

Table.1 – Groups of Ornamental Rocks by NCM. Adapted by: SINDIROCHAS, relatório mensal de exportações junho de 2020, pág. 15

Groups	NCM Code	NCM Description
Brute Carbonate Rocks	25151100	Marbles and Travertine, brute
	25151210	Sliced Marbles, in rectangular boards or blocks.
	25151220	Sliced Travertines in rectangular boards or blocks.
	25152000	Granites and other cornerstone or calcareous construction stones, alabastres
Brute Silicate Rocks	25062000	Quartzites, cut in saw or brute, or in rectangular boards or blocks
	25161100	Brute Granite
	25161200	Sliced Granites, in rectangular boards or blocks.
	25169000	Other construction Rocks
	25162000	Sandstone, cut in blocks, boards, or rectangular blocks
Manufactured Carbonatic Rocks	68022100	Marbles, travertine and alabaster, cut in saw with flat surface
	68029100	Marbles, travertine and alabaster, polished
	68029200	Other Calcareous rocks, polished
Manufactured Silicate Rocks	68021000	Tiles, cubes, tablets and similars, even in a shape other than rectangular, whose largest face can be inserted in a square with 7cm sides. Granules, fragments and powders, even if artificially coloured
	68022300	Granite, simply cut in saw, with flat and polished surface
	68022900	Other construction Rocks, cut in saw, with flat and polished surface

	68029990	Other construction Rocks manufactured in other ways
	68029390	Granites manufactured in other ways
Slates and Other Rocks	25140000	Slates, chopped or cut in saw, in blocks or boards in rectangular shape
	25261000	Natural Soapstone, chopped or cut in saw, in blocks or boards in a rectangular shape
	68010000	Paving stones, slabs for paving, of natural stones (except slates)
	68030000	Natural Slates and its works and its aggregates

The table above shows us the uses and classifications of rock groups, according to Brazilian and South American (Mercosul) standards agreed on NCM.

Before starting analyzing the numbers, however, extensive bibliographic research was realised. To do so, articles, books, dissertations and scientific magazines, and publications in general were scrutinized. The main goal of this step was to provide a background for the activities being developed.

In Brazil, the ornamental rock production chain is structured through the Local Productive Arrangements (APLs) (Suzigan 2006). These local arrangements are the union of small extractors that work nearby, and sharing common useful structures to minimize the operational costs, such as transport, equipment maintenance, machinery, etc. (Suzigan 2006). According to Slack et al (2002), the APL by process has as its main objectives, to minimize production costs that are associated with the extraction and transportation of the product, from the source to the consumer. There is research pointing to the advantages of business in agglomerations, that is growing in its concept and being driven toward better efficiency and competitiveness of business, regions and countries. (LASTRES; CASSIOLATO 2005)

In Brazil, the APLs grants competitiveness, in an environment that lacks adequate logistic infrastructure. An expressive sum of the extractors work this way.

In developed countries, ornamental rocks, brute or manufactured, are mainly transported through railways. In Brazil, the main transportation pathway is through highways, which elevates a lot the freight costs, reducing competitiveness (SUZIGAN 2006). Transportation was very affected by the pandemic, when countries implemented their lockdowns.

In relation to the COVID-19 pandemic, we had lockdowns in Brazil, that included highway blocks, blocked access to ports, and locked access to the shared APL infrastructure, which caused a lot of delays and impacts on the sector. Besides, port access was also blocked throughout the world, causing even more difficulties and delays, because is the main pathway by which Brazil imports and exports ornamental rocks. There was also an expressive fall in demand, caused by the COVID-19 pandemic.

III. RESULTS AND DISCUSSION

3.1 Imports

We begin analyzing the import market in its whole, by weight (tons), in the periods of study:

Table.1.1— Total ornamental rock imports in 1S18, 1S19 and 1S20, in US\$ and Tons. Source: comexstat.mdic.gov.br.

PERIOD	US\$	Tons (t)
1S18 (jan-jun)	15.280.947	26.046
1S19 (jan-jun)	11.201.086	21.386
1S20 (jan-jun)	8.737.007	17.125
Variation 1S18-1S19 (%)	-26,70%	-17,89%
Variation 1S19-1S20 (%)	-22,00%	-19,92%

We can note that imports had a negative variation, Brazil importing 20% less in 1S20 compared to 1S19 in weight.

To analyse which kind of rocks we exported the least, we classified by type as seen below:

Table 2 - Ornamental Rock imports in 1S18, 1S19 and 1S20, in FOB value, by type. Source: comexstat.mdic.gov.br.

Groups	2018 - Value FOB (US\$)	2019 - Value FOB (US\$)	2020 - Value FOB (US\$)	(%) Variation 1S18 - 1S19	(%) Variation 1S19 - 1S20
Slates and other rocks	575.681	295.548	293.955	-48,66%	-0,54%
Manufactured Silicate Rocks	2.156.579	1.132.605	1.402.238	-47,48%	23,81%
Brute Carbonatic Rocks	3.900.913	2.856.230	2.624.350	-26,78%	-8,12%
Manufactured Carbonatic Rocks	8.109.643	6.634.604	4.244.029	-18,19%	-36,03%
Brute Silicatic Rocks	538.131	282.099	172.435	-47,58%	-38,87%
Total	15.280.947	11.201.086	8.737.007	-26,70%	-22,00%

In this way it is possible to note that brute carbonatic rocks were along the most affected, along with manufactured carbonatic rocks, both having almost 40% less imports in 1S20 than in 1S19, but in contrast we noted an 23% increase in manufactured silicatic rocks, being this type the

only one that has increased in the period, showing that the market is demanding more of this type of product. We will look at price variations to better understand this results, as seen below:

Table 3 - Average price of the main brazilian ornamental rock imports. In blue: positive variations. in red: negative variations. Source: comexstat.mdic.gov.br.

Groups	2018 - Average Price	2019 - Average Price	2020 - Average Price	(%) Variation 1S18 - 1S19	(%) Variation 1S19 - 1S20
Slates and other rocks	734,29	631,51	701,56	-14,00%	11,09%
Manufactured Silicate Rocks	743,90	727,43	516,67	-2,21%	-28,97%
Brute Carbonatic Rocks	501,15	419,29	426,93	-16,33%	1,82%
Manufactured Carbonatic Rocks	606,78	566,48	570,28	-6,64%	0,67%
Brute Silicatic Rocks	442,91	337,04	426,82	-23,90%	26,64%
Total	586,67	523,76	510,16	-10,72%	-2,60%

A slight variation was observed between 2019 and 2020, but we should note that in relation to 2018 we had a 13% negative variation, denoting an expressive reduction in the analysed period.

The main natural ornamental rock exporters to brazil were Italy, Turkey, Indonesia and Spain, respectively, and the main artificial ornamental rock exporters to brazil were China, Spain and Greece, respectively. China has growing in its artificial rock export (ABIROCHAS 2020).

3.2 Exports

The export market in bulk numbers also show a considerable reduction when 1S19 and 1S20 are analyzed, as shown in the table below:

Table 4 - Total brazilian ornamental rock exports in 1S18, 1S19 and 1S20. Source: comexstat.mdic.gov.br.

PERIOD	Value US\$	Weight (tons)
1S18 (jan-jun)	457.148.853	999.851
1S19 (jan-jun)	489.579.456	989.887
1S20 (jan-jun)	398.046.003	928.034
Variation 1S18-1S19 (%)	7,09%	-1,00%
Variation 1S19-1S20 (%)	-18,70%	-6,25%

It is possible to note in table 04 a reduction in demand in the last 3 years, both in weight and price, and we can see that in 2020 the reduction was a lot more significant.

In the table below we describe these total values in FOB US\$, specifying the rock type:

Table 5 - Ornamental Rocks exports in 1S18, 1S19 and 1S20, in FOB US\$, by rock type. Source: comexstat.mdic.gov.br.

Groups	2018 - Value (US\$)	2019 - Value (US\$)	2020 - Value (US\$)	1S18 - 1S19 Variation (%)	1S19 - 1S20 Variation (%)
Manufactured Silicate Rocks	312.822.592	344.757.930	261.098.137	10,21%	-24,27%
Slates and other rocks	24.256.654	25.717.633	20.229.314	6,02%	-21,34%
Brute Carbonatic Rocks	4.368.166	5.809.048	7.037.697	32,99%	21,15%
Manufactured Carbonatic Rocks	21.016.773	28.855.793	25.501.355	37,30%	-11,62%
Brute Silicate Rocks	94.684.668	84.439.052	84.179.500	-10,82%	-0,31%
Total	457.148.853	489.579.456	398.046.003	7,09%	-18,70%

We can note in table 05 that manufactured silicate rocks and slates had a smaller variation than the other rock types, that presented significant reduction.

It is evident from tables 04 and 05 the good moment experienced by the sector in 2018 through 2019. There was significant grow in export weight and value to the main importers. This scenario changes dramatically when we analyse the 2019-2020 period. In these period,

we can observe a significant reduction in almost all export categories, in exception to brute carbonatic rocks, that increased 21%, against the trend. The totals were greatly affected, with prices falling 18%, almost 3x the reduction in weight (-6,25%) (Table 1)

In the table below we describe the average price by rock type, to better appreciate the details of exports:

Table 6 - Variations in average export prices between 1S18, 1S19 and 1S20, in percentage. Average price in US\$ per ton.

Source: comexstat.mdic.gov.br.

Groups	2018 - Average Price (US\$/t)	2019 - Average Price (US\$/t)	2020 - Average Price (US\$/t)	1S18 - 1S19 Variation (%)	1S19 - 1S20 Variation (%)
Manufactured Silicate Rocks	709,36	716,91	674,63	1,07%	-5,90%
Slates and other rocks	385,59	368,28	346,47	-4,49%	-5,92%
Brute Carbonatic Rocks	387,39	350,81	419,13	-9,44%	19,48%
Manufactured Carbonatic Rocks	1007,53	1006,48	908,49	-0,10%	-9,74%
Brute Silicate Rocks	204,14	214,35	192,30	5,00%	-10,29%
Total	457,22	494,58	428,91	8,17%	-13,28%

We can note in table 6 that brute silicate rocks had a smaller reduction than the other rock types. We

follow analyzing weight and rock type in the period of study:

Table.7- Variations in weight of ornamental rock exports in the periods analysed, in percentage. Source: comexstat.mdic.gov.br.

Groups	2018 – weight(T)	2019 – weight(T)	2020 – weight(T)	(%) Variation 1S18 - 1S19	(%) Variation 1S19 - 1S20
Slates and other rocks	784	468	419	-40,31%	-10,47%
Manufactured Silicate Rocks	2.899	1.557	2.714	-46,29%	74,31%
Brute Carbonatic Rocks	7.784	6.812	6.147	-12,49%	-9,76%
Manufactured Carbonatic Rocks	13.365	11.712	7.442	-12,37%	-36,46%
Brute Silicatic Rocks	1.215	837	404	-31,11%	-51,73%
Total	26.047	21.386	17.126	-17,89%	-19,92%

We can observe a very great reduction in weight exports, in tons, showing that we exported a gradatively smaller amount in 2020 than in the previous years, but

brute carbonate rocks were against the trend, with a whopping 75% increase in 1S20 compared to 1S19.

In the table below we present weight variations in the periods analysed according to rock type:

Table 8 - Ornamental Rock Exports in 1S19 and 1S20, in weight (tons), by rock type. Source: comexstat.mdic.gov.br.

Grupos	2018 - Peso (t)	2019 - Peso (t)	2020 - Peso (t)	(%) Variação 1S18 - 1S19	(%) Variação 1S19 - 1S20
Manufactured Silicate Rocks	440.995	480.891	387.026	9,05%	-19,52%
Slates and other rocks	62.908	69.832	58.387	11,01%	-16,39%
Brute Carbonatic Rocks	11.276	16.559	16.791	46,86%	1,40%
Manufactured Carbonatic Rocks	20.860	28.670	28.070	37,44%	-2,09%
Brute Silicate Rocks	463.812	393.935	437.759	-15,07%	11,12%
Total	999.851	989.887	928.033	-1,00%	-6,25%

Slates and manufactured silicate rocks were amongst the ones that had significant reduction in the period.

Looking to the marbles data we can note that even with a small weight in exports, it has registered positive variation in weight, value and average price. and granite and quartzite exports had an increase driven by quartzites but even though had a 1.7% reduction in FOB US\$ value and 2.2% reduction in weight, with a 0.6% increase in average price.

The most affected rock types were the manufactured ones, with a significant 13.2% reduction in FOB US\$ price, 8.8% reduction in weight and 4.8%

reduction in average price, being the most important factor that contributed to the bad performance of the Brazilian ornamental rock exports.

The artificial rocks exports also had a small weight, being United States our biggest importer, but this rock type had increased demand in the period analysed, summing US\$14,6 millions and 25,2 Mt, varying positively by 11 and 24,3% respectively. The most important consumers were China, Spain and Greece with remarks to China's demands.

In table 09 below we describe the main countries to which Brazil exports:

Table 9 - Average price of the main Brazilian ornamental rock importers. In blue: positive values. In red: negative values.

Source: comexstat.mdic.gov.br.

Country	jun/18	jun/19	jun/20	(%) Average Price Variation 1S18 - 1S19	(%) Average Price Variation 1S19 - 1S20
	Average Price (US\$/t)	Average Price (US\$/t)	Average Price (US\$/t)		
China	168,05	202,47	142,20	20,48%	-29,76%
United States	711,28	711,07	615,05	-0,03%	-13,50%
Italy	573,88	449,71	491,07	-21,64%	9,20%
Taiwan	270,31	135,17	193,96	-49,99%	43,49%
United Kingdom	383,21	370,80	345,97	-3,24%	-6,69%
México	671,22	541,71	475,38	-19,29%	-12,25%
Hong Kong	224,54	229,40	64,60	2,17%	-71,84%
Germany	556,24	446,00	456,84	-19,82%	2,43%
Spain	826,43	625,59	869,21	-24,30%	38,94%
Paraguay	247,81	217,34	214,96	-12,30%	-1,10%
Vietnam	476,91	1048,74	935,45	119,90%	-10,80%
Colombia	469,29	415,69	358,54	-11,42%	-13,75%
Poland	422,82	325,91	516,57	-22,92%	58,50%
Canada	1018,54	1089,02	1345,73	6,92%	23,57%
Costa Rica	480,37	430,89	325,04	-10,30%	-24,57%

According to table 09 is possible to note that most countries had negative variations when 1S19 is compared to 1S20.

The table below configures the main destinies of Brazilian ornamental rock exports, showing reduction in 2020.

Table 10 – Brazilian exports in weight (tons) to the main importer countries. In blue: positive values. In red: negative values.

Source: comexstat.mdic.gov.br.

Country	2018 - Weight (t)	2019 - Weight (t)	2020 - Weight (t)	(%) Variation 1S18 - 1S19	(%) Variation 1S19 - 1S20
China	361.289	294.897	358.568	-18,38%	21,59%
United States	388.224	424.279	346.515	9,29%	-18,33%
Italy	63.803	62.899	58.155	-1,42%	-7,54%
United Kingdom	20.353	25.036	27.699	23,01%	10,64%
México	20.903	24.870	23.698	18,98%	-4,71%
Hong Kong	9.448	5.824	5.206	-38,35%	-10,62%
Germany	8.528	9.000	8.465	5,54%	-5,94%
Spain	5.999	8.023	6.556	33,74%	-18,28%
Paraguay	1.356	2.834	2.877	108,98%	1,51%

Vietnam	1.815	3.338	4.421	83,98%	32,42%
Colombia	7.475	7.404	6.105	-0,94%	-17,56%
Poland	2.598	5.256	3.207	102,32%	-38,98%
Canada	7.886	8.136	5.265	3,18%	-35,29%
Costa Rica	1.432	1.436	1.625	0,23%	13,22%

Table 11 - Brazilian ornamental rock exports in 1S28, 1S19 and 1S20, by country. In blue: positive values. In red: negative values. Source: comexstat.mdic.gov.br.

Country	2018 - Value (US\$)	2019 - Value (US\$)	2020 - Value (US\$)	1S18 - 1S19 Variation (%)	1S19 - 1S20 Variation (%)
China	64.184.039	52.321.666	52.918.726	-18,48%	1,14%
united States	275.235.857	305.940.584	236.411.948	11,16%	-22,73%
Italy	31.509.271	30.988.203	31.101.286	-1,65%	0,36%
United Kingdom	7.808.392	9.015.176	9.216.661	15,45%	2,23%
Mexico	12.603.359	14.331.322	12.893.136	13,71%	-10,04%
Hong Kong	2.420.682	1.464.188	1.025.001	-39,51%	-30,00%
Germany	4.183.966	4.860.720	3.894.331	16,17%	-19,88%
Spain	4.515.748	5.438.958	4.685.362	20,44%	-13,86%
Paraguay	367.528	440.188	615.139	19,77%	39,74%
Vietnam	1.700.658	2.979.824	3.193.097	75,22%	7,16%
Colombia	3.424.409	3.341.949	2.475.109	-2,41%	-25,94%
Poland	1.212.841	2.393.859	1.913.501	97,38%	-20,07%
Canada	7.635.474	8.503.516	5.655.426	11,37%	-33,49%
Costa Rica	672.961	693.159	653.582	3,00%	-5,71%

Following this global analysis, in the table below we see the variation in the average price of the main importer countries:

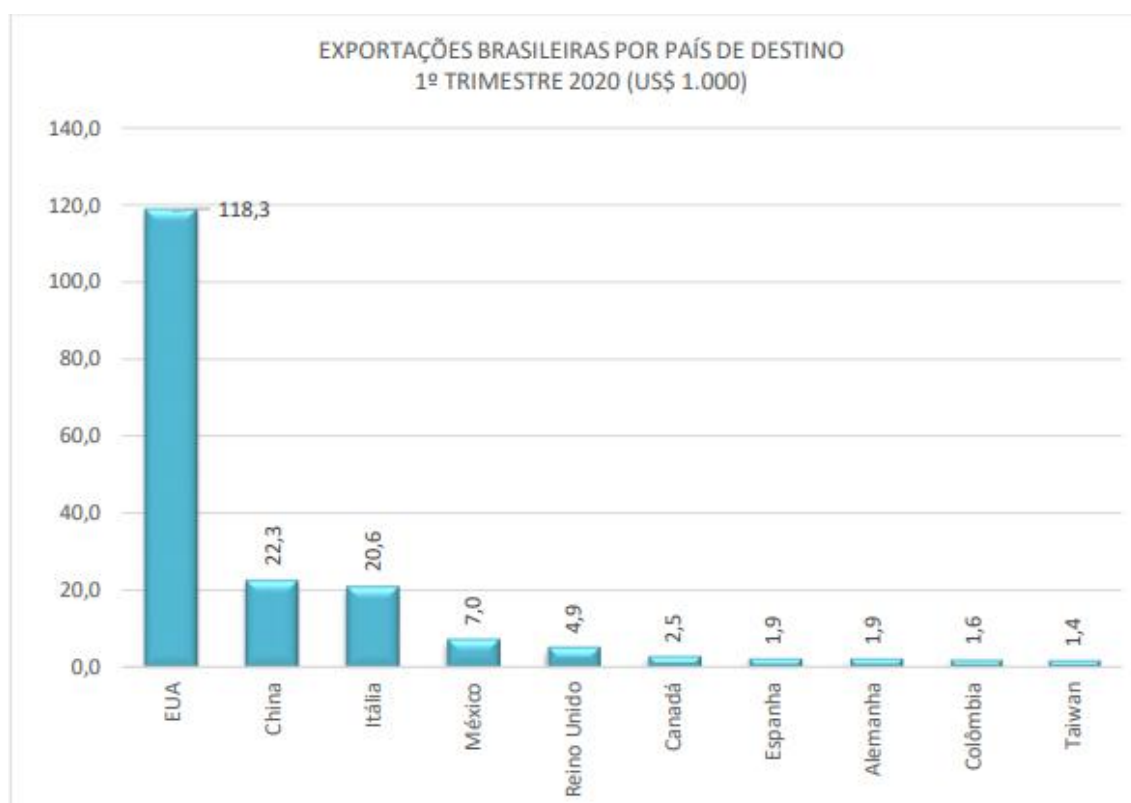
Table 12 - Average price of the main ornamental rock importers of Brazil. in blue: positive values. In red: negative values.

Source: comexstat.mdic.gov.br.

Country	2018 - Average Price FOB US\$ per ton	2019 - Average Price FOB US\$ per ton	2020 - Average Price FOB US\$ per ton	(%) Variation 1S18 - 1S19	(%) Variation 1S19 - 1S20
Turquia	433,56	402,39	395,17	-7,19%	-1,79%
Itália	710,58	586,70	626,46	-17,43%	6,78%
Espanha	477,15	435,29	493,54	-8,77%	13,38%
Indonésia	600,34	537,45	548,31	-10,48%	2,02%
China	766,48	774,72	556,74	1,07%	-28,14%
México	514,58	462,64	439,02	-10,09%	-5,11%
Portugal	487,42	470,21	468,46	-3,53%	-0,37%

Grécia	566,42	755,93	669,67	33,46%	-11,41%
Egito	330,45	283,99	291,71	-14,06%	2,72%
Namíbia	0,00	282,80	404,81	0,00%	43,15%
Total	582,46	523,92	509,20	-10,05%	-2,81%

We can note that China, one of the main global importers had a significant reduction in average price in the period analysed. In the chart below we detail the main brazilian importers by country:



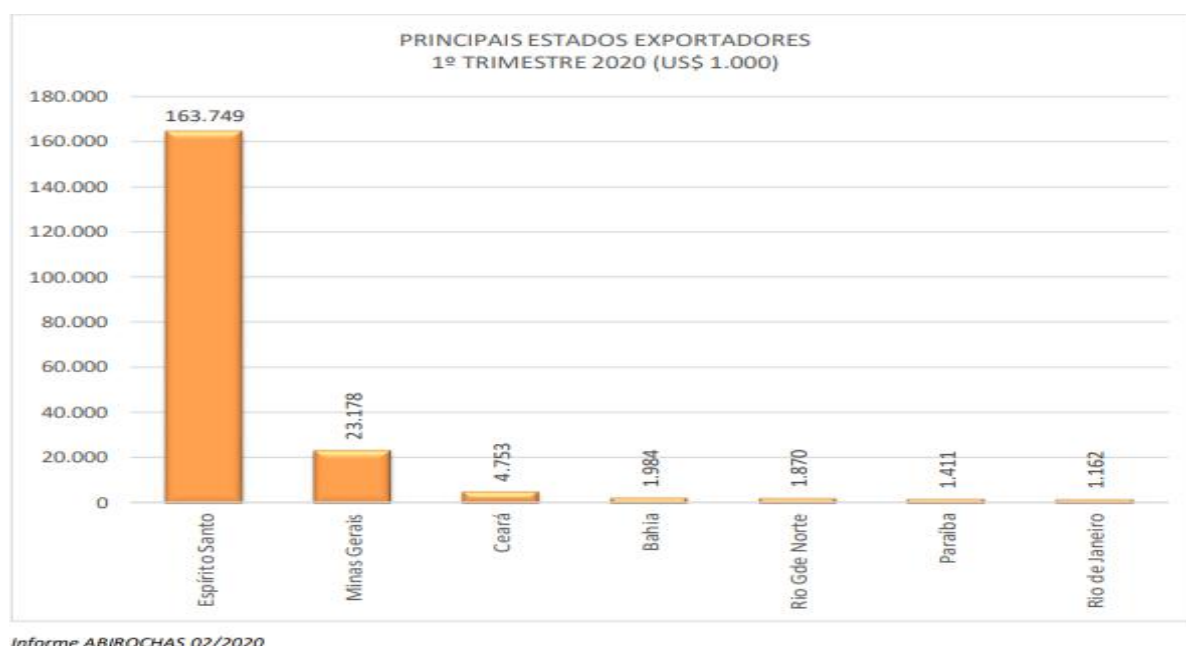
Source: Associação Brasileira da Indústria de Rochas Ornamentais (2020)

United States are still brazilian's biggest ornamental rock importer, but we can note the ever-growing participation of China in this market.

We exported a total of US\$ 118,3 million, composing a total of 59,1% of all brazilian exports. China and Italy come close and consolidate as our best

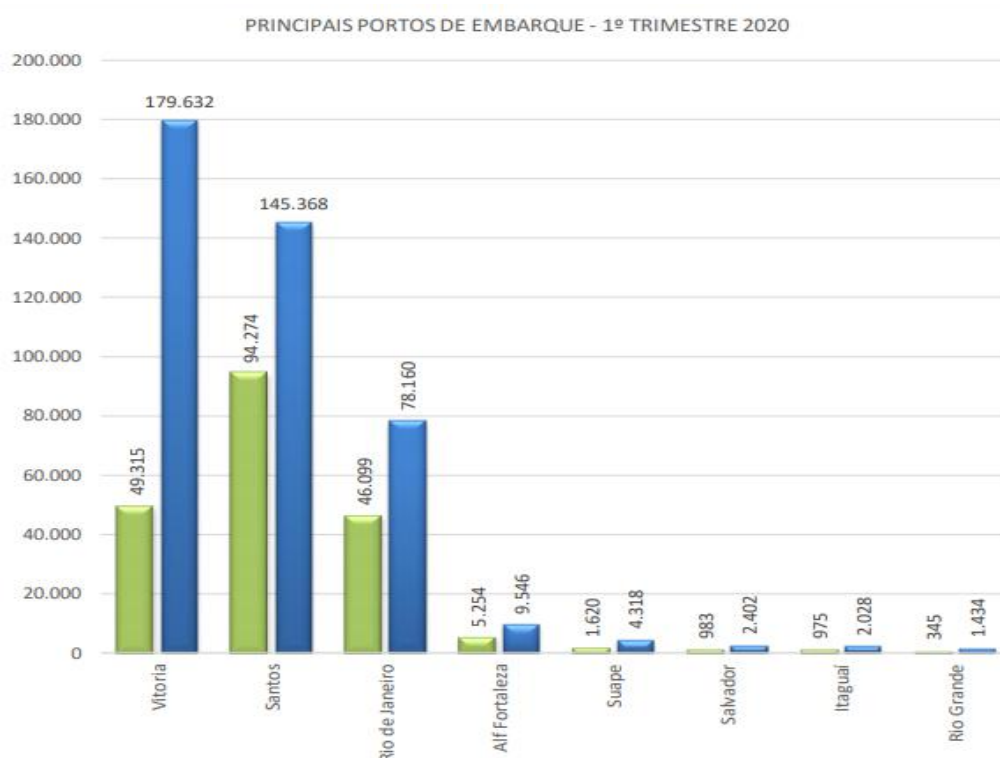
ornamental rock trading partners, as buyers, china having only 11,1% of the exports share.

In the internal market we can note that few has changed, being Espírito Santo, Minas Gerais and Ceará, the biggest ornamental rock producers, respectively



Source: Associação Brasileira da Indústria de Rochas Ornamentais (2020)

The main export routes are through marine ports, with no big changes, being Vitoria port, Santos port and Rio de Janeiro ports, the main pathways that Brazil exports its rocks.



Source: Associação Brasileira da Indústria de Rochas Ornamentais (2020)

We can note a larger concentration of exports in the southern states of Brazil. Its important to analyse the number of cases of COVID-19 in the world, to better

understan the moments of most severity of the pandemic in each country, and its economic closures and reopenings, as illustrated in the chart below:

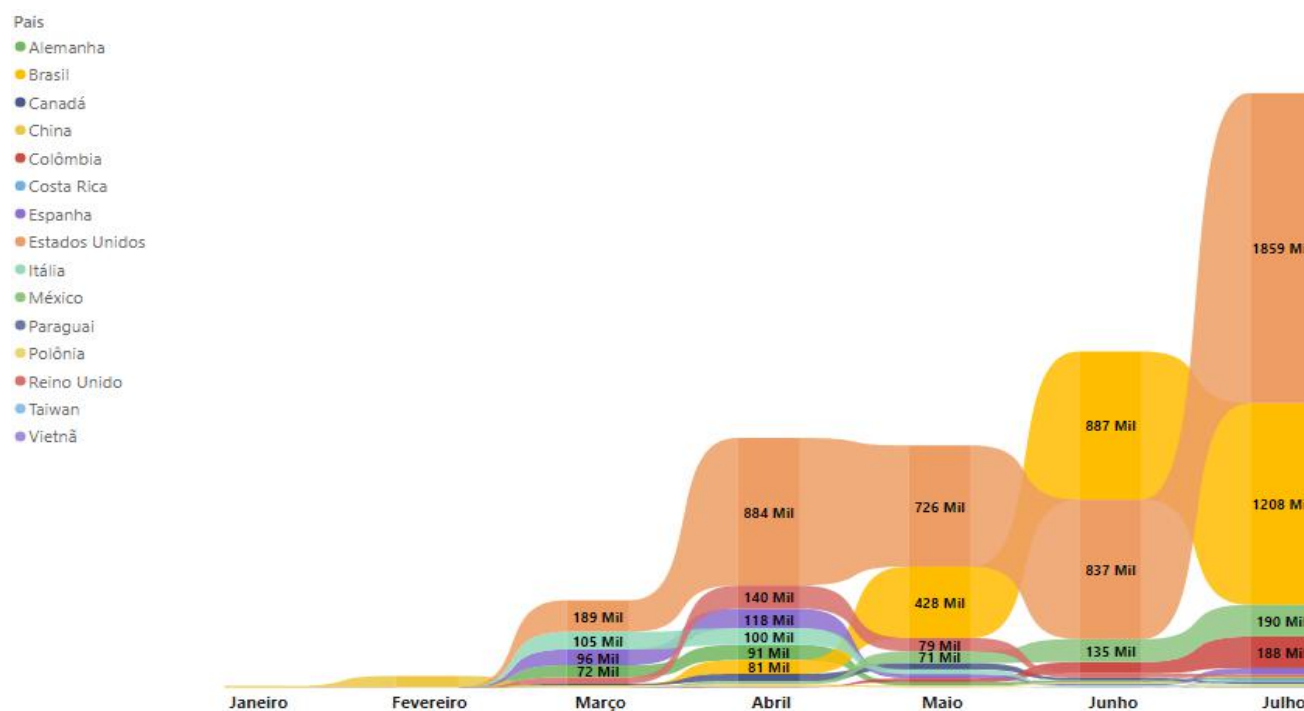


Chart 1 - Total by month and country of study. Data from John Hopkins University (July 2020). China e Hong Kong (Tabela 5) are represented in this chart only as China

We can analyse by this perspective and see it more clearly in the chart below:

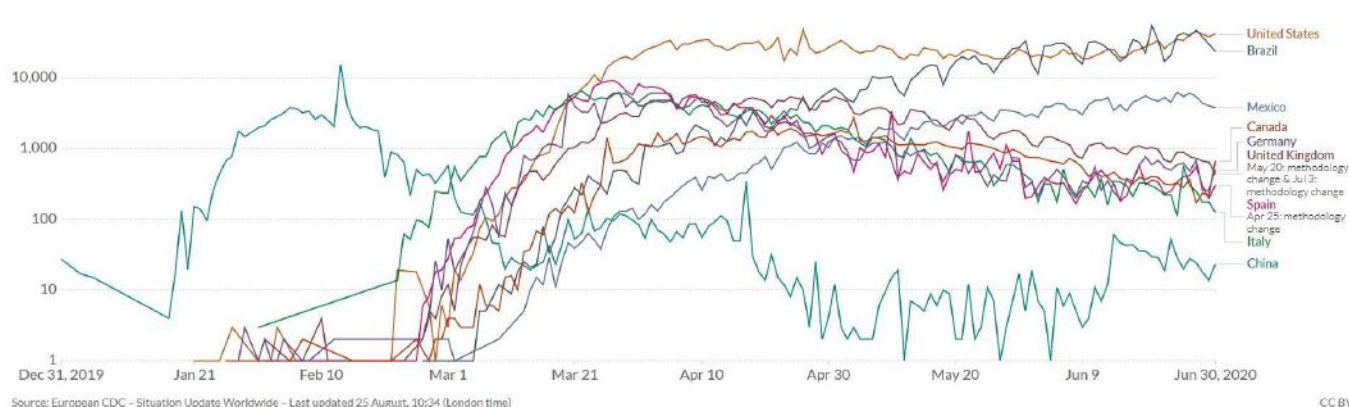


Chart 02 – New cases of COVID-19 by day and country of study Source: (Roser, Ortiz-Ospina, Hesell, 2020). China e Hong Kong (Tabela 5) are represented in this chart only by China

Through the chart 02 we can note that china was leading the number of new cases in the beginning of the pandemic, with european countries following in a second moment, with Brazil and United States following the leadership in a late moment.

Various factors must be observed to analyse these results. Firstly, it is obvious the coincidence between the most severe moments of the pandemic (January through June 2020), as expressed in Chart 1, and the bad performance of the ornamental rock exports of Brazil. We

also need to observe that changes in supply and demand seem to show a tendency toward bigger exports of brute products and smaller exports of manufactured products during the pandemic. This can be explained by the adaptation of the consumers to the new moment, more financially restricted, in which the consumers shifted toward products with cheaper average prices, buying brute to manufacture later.

We can also observe that a significant reduction in the average price of exported products (Table 12). With

excesso of brute carbonatic rocks, that had a 19,48% increase in 1S20, all other rock types presented a reduction in value per ton. This confirms the impacts of the pandemic in the brazilian export market of ornamento rocks, and agrees with the interpretation that the demand shifted towards brute products relative to the manufactured ones in the period investigated.

With relation to the exported weight, we observe a little different tendency: in the 1S18 - 1S19 period, there was no significant changes in the total exported weight, but there was reduction in the total brute rocks exported in relation to the manufactured ones, that experienced pronounced increase. Since the brasilian export profile is composed of mainly silicatic brute rocks, its 15,07% reduction balanced the totals, denoting a moment of stability in the market, that agrees to the 1S18 - 1S19 increase in average prices. That picture changes if we look at the 1S19-1S20 interval, that showed a reduction in both total value and weight. This depicts the impacts of the pandemic in the brazilian ornamental rock market.

IV. CONCLUSION

The impacts of the pandemic on the brazilian rock market in notorious. The sector was very affected, and is going through difficulties because of it. The generalized reduction in average prices per ton, and the reduction exports in the market, can drive a lot of producer out of business.

It is important to mention that this data is reflecting only the initial period of the pandemic in Brazil, and there are more impacts that will appear in the forthcoming months, or even years.

There is also a shift in the market toward artificial products, mainly driven by China. The reduction in the imports of natural rock material supports this observation.

In relation to the natural materials, there was an increase in the exported volume of manufactured silicatic rocks, products as granites and polished slabs are the most demanded, with increase in average price.

The reductions in exports were expressive, but the brute carbonatic rocks showed an increase, against the general tendency.

The United States, Italy and China are still our most important commercial partners in the ornamental rock market.

REFERENCES

- [1] Associação Brasileira da Indústria de Rochas Ornamentais (2020). Síntese das Exportações e Importações Brasileiras de Rochas Ornamentais no Período Janeiro-Março de 2020. Brasília, Brazil: abirochas.com.br/wp-content/uploads/2019/04/Informe_02_2019_1Trimestre.pdf (acessado em 28/07/2020)
- [2] Costa, J. (2001). Caracterização mineralógica e tecnológica de uma jazida de serpentinito como rocha ornamental (Mestre). Escola de Minas, Universidade Federal de Ouro Preto. Ouro Preto – MG.
- [3] Slack, N, Chambers, S & Johnston, R. (2018). Administração da produção. (8nd ed.). São Paulo, Brazil: Atlas.
- [4] Sindirochas, Demanda internacional por pedras naturais brasileiras movimentou economia capixaba neste início de ano, 23 de Janeiro de 2019
<https://www.sindirochas.com/noticia.php?url=demanda-internacional-por-pedras-naturais-brasileiras-movimentou-economia-capixaba-neste-inicio-de-ano#:~:text=Pa%C3%ADses%20como%20Estados%20Unidos%2C%20M%C3%A9xico,brasileiras%20de%20m%C3%A1rmore%20e%20granito> (Acessado em 28/07/2020)
- [5] Sindirochas, relatório de exportações de rochas de junho 2018:
<https://www.sindirochas.com/downloads/relatorios/exportacoes-sindirochas-junho-2020.pdf>, acesso em 12/07/2020
- [6] Sindirochas, relatório de exportações de rochas de junho 2019:
<https://www.sindirochas.com/downloads/relatorios/exportacoes-sindirochas-junho-2020.pdf>, acesso em 12/07/2020
- [7] Sindirochas, relatório de exportações de rochas de junho 2020:
<https://www.sindirochas.com/downloads/relatorios/exportacoes-sindirochas-junho-2020.pdf>, acesso em 12/07/2020
- [8] Khan I, Haleem A, Javaid M, *Analysing COVID-19 pandemic through cases, deaths, and recoveries*, *Journal of Oral Biology and Craniofacial Research* (2020) doi: <https://doi.org/10.1016/j.jobcr.2020.08.003>
- [9] McKibbin, Warwick J. and Fernando, Roshen, The Global Macroeconomic Impacts of COVID-19: Seven Scenarios (March 2, 2020). CAMA Working Paper No. 19/2020, Available at SSRN: <https://ssrn.com/abstract=3547729> or <http://dx.doi.org/10.2139/ssrn.3547729>
- [10] Ozili, Peterson K and Arun, Thankom, Spillover of COVID-19: Impact on the Global Economy (March 27, 2020). Available at SSRN: <https://ssrn.com/abstract=3562570> or <http://dx.doi.org/10.2139/ssrn.3562570>
- [11] Associação Brasileira de Normas Técnicas – ABNT (NBR 15844), Brasil, 2015: <https://www.normas.com.br/visualizador-slim/Viewer.asp?ns=29595&token=65cb4015-293e-489b-ae8e-43667d75bb47&sid=1dga4d45e3j5gptso5nag3vc&email=diorgenesdossantos6@gmail.com>

- [12] SUZIGAN, W. Identificação, mapeamento e caracterização estrutural de arranjos produtivos locais no Brasil. Relatório Consolidado. Rio de Janeiro: IPEA, 2006.
- [13] Cassiolato, José Eduardo, & Lastres, Helena Maria Martins. (2005). Sistemas de inovação e desenvolvimento: as implicações de política. *São Paulo em Perspectiva*, 19(1), 34-45. <https://doi.org/10.1590/S0102-88392005000100003>
- [14] Max Roser, Hannah Ritchie, Esteban Ortiz-Ospina and Joe Hasell (2020) - "*Coronavirus Pandemic (COVID-19)*". Published online at OurWorldInData.org. Retrieved from: '<https://ourworldindata.org/coronavirus>' [Online Resource]